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and ten method, and is demonstrated thus : The square of the hypotenuse, or longest side of a right-angled triangle, being equal to the sum of the squares of the other two sides, the same property must always be inherent in any three numbers, of which the squares of the two lesser numbers added together are equal to the square of the greater. For example, take the numbers six, eight, and ten ; the square of six is thirty-six, and the square of eight is sixty-four ; and thirty-six and sixty-four added together make one hundred, which is ten times ten, or the square of the greater number. Although these numbers, or any multiple of them, such as three, four, five, or twelve, sixteen, twenty, etc., are the most simple and most easily retained in the memory, yet there are other numbers, very different in proportion, which can be made to serve the same purpose ; and for the advanced student we submit the following : Let  $n$  denote any number ; then  $n^2 + 1$ ,  $n^2 - 1$ , and  $2n$ , will represent the hypotenuse, base, and perpendicular of a right-angled triangle. Suppose  $n = 6$ , then  $n^2 + 1 = 37$ ,  $n^2 - 1 = 35$ , and  $2n = 12$  ; hence, thirty-seven, thirty-five, and twelve are the sides of a right-angled triangle.

To bisect a given straight line, let A B, Fig. 7, be the given straight line. From the extreme points A and B as centres, with any equal radii greater than half the length of A B, describe arcs cutting each other in C and D : a straight line drawn through the points of intersection C and D will bisect the line A B in  $e$ .

To divide a given straight line into any number of equal parts. Let A B, Fig. 8, be the given line to be divided into five equal parts. From the point A draw the straight line A C, forming any angle with A B. On the line A C, with any convenient opening of the compasses, set off five equal parts towards C ; join the extreme points C B ; through the remaining points one, two, three, and four, draw lines parallel to B C, cutting A B in the corresponding points, one, two, three, four : A B will be divided into five equal parts, as required.

To describe an equilateral triangle upon a given straight line. Let A B, Fig. 9, be the given straight line ; from the points A and B, with a radius equal to A B, describe arcs intersecting each other in the point C. Join C A and C B, and A B C will be the equilateral triangle required. An eminent mathematician once made the following observation regarding this problem : "It is remarkable that it is not perhaps possible to resolve, without employing the arc of a circle, the very simple problem, and one of the first in the elements of geometry, viz., to describe an equilateral triangle." "We have often attempted it," continues the same au-

thor, "but without success, while trying how far we could proceed in geometry by means of straight lines only." He did well to put in the *perhaps*, for the thing happens to be possible after all ; but it shows by what trifle the greatest of men will sometimes be baffled. The following is submitted as a method remarkably simple and easy : Let A B, Fig. 10, be the given straight line, it is required to describe an equilateral triangle upon it without making use of the compasses or arcs of a circle. Bisect A B in D, as shown previously, draw A E perpendicular and equal to A D ; join D E, and extend D A to F, making A F = D E ; join also E F ; then from D erect the perpendicular D C = E F, and join A C and C B : A B C will then be an equilateral triangle.

It is easy to see that  $A C^2$  must be  $4A D^2$  ; but  $A C^2 = A D^2 + C D^2$  (47th Prop. Euclid), and  $C D^2 = E F^2 = F A^2 + A E^2 = A E^2 + D E^2$  ; but  $D E^2 = A D^2 + A E^2 = 2A D^2$ . . .  $C D^2 = 3A D^2$ , and  $A C = A B = 4A D^2$ .

(To be continued.)

## Intercommunication.

This department is intended to furnish, for the benefit of all our readers, practical information regarding the art of manipulating wood by hand or machinery ; and we trust that every reader of our paper will make the fullest use of it, both in asking and answering. All persons possessing additional or more correct information than that which is given relating to the queries published, are cordially invited to forward it to us for publication. All questions will be numbered, and in replying it will be absolutely necessary, in order to secure due insertion, that the NUMBER and TITLE of the question answered should be given ; and in sending questions, the title of key-words of the question should be placed at the head of the paper. Correspondents should in all cases send their addresses, not necessarily for publication, but for future reference. We also request that all questions or answers be written on separate slips of paper, and addressed to the Editor. Notes of practical interest will be welcome at all times. When drawings are sent to illustrate answers to questions, or for full pages, they should be on separate slips, and should be drawn in ink on clean, white paper. Short questions, requiring short answers, may be asked and answered through the agency of postal cards.

When answers to questions are wanted by mail, the querist must send a stamp for return postage.

## Queries.

1. PLANE IRONS.—Why are Butcher's plane irons marked with numbers one, two, three, four, etc.?—A. P. G.
2. PICTURE-FRAMES.—Is it best, in making picture-frames, to glue them at the corners, which is "endwood," or just brad them together?—A. P. G.
3. FILLING.—How can I make a good filling for chestnut and black-walnut?—A. P. G.
4. COMBINATION PLANES.—What firm manufactures the best combination match planes and fillisters of iron in this country ; and do these combination planes soon get out of order by frequent changing?—A. P. G.

5. **HARDWOOD PINS.**—In pinning frame buildings together, such as barns, bridges, timber roofs, etc., is it better to use dry hickory than that which is green or partly seasoned?—A. P. G.

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## Correspondence.

### Mansard Hips.

*To the Editor of the Illustrated Wood-Worker:*

Let "A Subscriber" try the following to get the curve of a hip rafter: Fig. 1, Plate 7, is the common rafter, A B the seat, C D the seat of the hip (an angle of 45°). Make as many points on the curve of the common rafter as you like, and from those points drop plumb ordinates cutting C D; transfer C D with all the points thereon to a level line, as C D, Fig. 2, and from those points erect plumb ordinates each of the same length as its corresponding number in Fig. 1, and the points thus found are points on the curve of the hip. This may be old for all I know, but it is good and reliable.

ALONZO.

BOSTON, Nov. 14, 1878.

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## Technical Education.

It has become quite the thing of late to write concerning the great necessity that exists for an improvement in the technical education of the masses, and as a result the inquiry is now by no means infrequent, What is technical education? We intend in the present and future issues of this paper to answer this query by giving our readers an opportunity to cull from our pages such information as will convince them as to what is technical education. The plasterer who burns his lime, slakes it, mixes it with sand, and finally makes it into mortar, may thoroughly understand the mechanical processes by which the raw stone is converted into mortar; and, therefore, be a practical "hand" in the manufacture of mortar; but how few plasterers there are that understand the chemical change that takes place in the constituents they employ. Again, the painter possibly knows nothing of the chemical constituents of the various substances he uses, or the reason why such and such effects are produced by the materials he employs. How much better workman he would be if possessed of that knowledge, must be evident to the least observant. A knowledge of the "why," in every branch of trade, would be of immense service to all concerned in the work, and the superior intelligence of the workman would most assuredly enhance the value of the work produced, as it would bear the impress of

superior skill and workmanship, and increase his value as a workman.

Chemistry, mining, geology—science and art—should go out together into all our cities, towns, and hamlets, assisted by government subsidies. No money could be better spent, for technical education would then become general, workmen more valuable, foreign competition from any point reduced to a minimum, the "level" of wages would become an obsolete phrase, and the chances of strikes all but impossible. It would also soon be observed that "waste" in all trades would be greatly reduced in quantity; and thus for the expenditure of a few thousands a year, for say the next ten years, there would ensue to the nation a gain of millions. This would be a casting of the bread on the waters productive of a safe return.

No doubt the stimulus given to the study of art and science since the Centennial Exhibition has been productive of immense material results; it may safely be asserted that the spreading of the knowledge of chemistry, geology, and mechanics amongst the working and the growing youth of the population would be twenty times more productive.

Something should be done in this direction before long, and we hope that our legislators will lay aside their political squabbles for a time, and wrestle with something that will be of real and lasting good to the nation. It is all very well to tell the workman that he possesses the franchise, and should therefore rest content; politically, this is but a poor substitute for the strength and blessings that education bestows.

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## House-Planning.

If persons who are about to have houses erected, either for their own use or for the use of their tenants, would give the subject as much thought as they would expend on any other equally important subject, there would be fewer badly constructed and ill-devised than there now are. Each family, for organic and numeral reasons, requires a house different and distinct in appointment and character from that of any of its neighbors. It is quite true that families, different in characteristics, may live and enjoy a certain amount of comfort in similarly constructed and appointed houses, but this apparent enjoyment is obtained at the expense of overwork or inconvenience of some one or more of the members of the household. When the houses are rented, this overwork or inconvenience cannot well be avoided, but it may be mitigated by a little foresight and ingenuity on the part of the members; but, in a new house, built for the persons who are